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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H04Q 7/22, 7/32 — A1

(11) International Publication Number: **WO 00/18156**

(43) International Publication Date: 30 March 2000 (30.03.00)

(21) International Application Number: PCT/SE99/01638

(22) International Filing Date: 20 September 1999 (20.09.99)

(30) Priority Data:
9803189-1 21 September 1998 (21.09.98) SE

(81) Designated States: EE, LT, LV, NO, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

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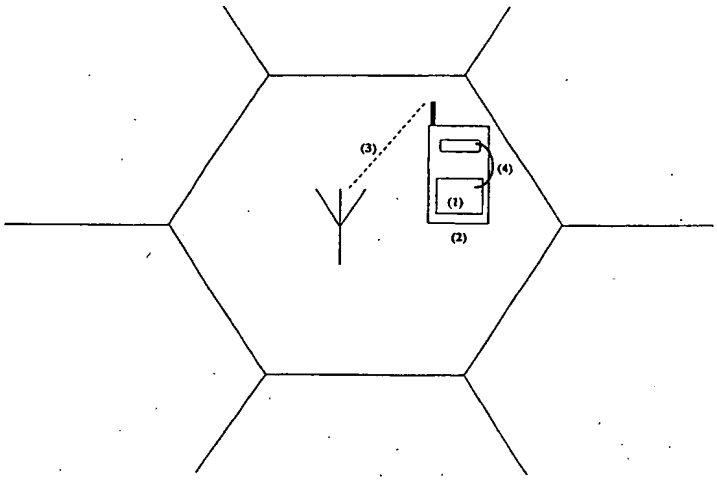
(54) Title: FUNCTIONALITY IN MOBILE TELEPHONE NETWORKS



(57) Abstract

The invention implies a possibility to differentiate the services a mobile telephone subscriber has access to in a cellular mobile telephone network. The functionality can be differentiated both in time and space. The subscriber is by the invention given specific functionality in a geographical limited area (20). The subscriber can for instance have full access to the mobile telephone network when he/she uses the mobile telephone within a certain area (20), whereas outside this area (21) he/she is only given a certain functionality, no functionality, or full functionality but at another price rate. There is also possibility to identify several areas with differentiated functionality. In the same way the subscriber can be given specific functionality at certain times during the 24–hour period, or during certain days. By means of SIM Application Toolkit the whole functional differentiation can be managed from the SIM–card (1). The subscriber's functional differentiation can in a simple way be changed because the list over allowed/wanted areas exists in the SIM–card and can be updated via data message (3).

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FUNCTIONALITY IN MOBILE TELEPHONE NETWORKS

TECHNICAL FIELD

The invention implies a possibility to differentiate the services to which a mobile telephone subscriber has access in a cellular mobile telephone network. The functionality can be differentiated in both time and space.

The subscriber is by the invention given a specific functionality in a geographically limited area. The subscriber can for instance have full access to the mobile telephone network when he/she uses the mobile telephone within a certain area, whereas he/she outside this area is given only a specific functionality, no functionality, or full functionality but at another price rate. There also is possibility to identify a number of areas with differentiated functionality. In the same way the subscriber can be given specific functionality during certain periods of the twenty-four hour period, or during certain days.

There also is possibility that the functionality limitation is changed. Such changes can be introduced at request of the subscriber, or of the mobile telephone operator in connection with maintenance or disruptions in the mobile telephone network.

The invention is i.a. interesting in the case when the mobile telephone operator wants to have possibility to give subscribers chance to, in a limited geographical area, have a lower price rate, or to limit the subscriber´s functionality outside a certain area.

PRIOR ART

In previous technical solutions within the same fields, all functionality has been concentrated to the network.

This described solution implies that the control of the functionality differentiation is made from the mobile telephone, for instance from the SIM-card. Possibility to realisation of the technical solution exists by the existing ETSI-standard GSM 11.14 - "SIM Application Toolkit". The standard defines commands and procedures which makes it possible for an application in the SIM-card to control certain functions of the mobile telephone and also to have a dialogue with the user.

TECHNICAL PROBLEM

Services of the type "office telephony" or "town telephony", i.e. services where the subscriber is given different possibilities depending on where he/she is, requires that one can limit or follow a mobile telephone subscriber's movements in the network. Support for this can be implemented in the network, but such a solution requires comparatively large investments and results in an increased load on signal networks and exchanges - especially if the functionality shall be possible to be differentiated between different subscribers. The technical solution which is described in the invention, means that an application in the SIM-card controls the differentiation of the functionality of the mobile telephone. By the application being located to the mobile telephone, the investment in the network is reduced and an increased load on the signal network is avoided.

At rapid expansion of the utilisation of a mobile telephone network or at disruptions in the traffic, it can be

difficult for the mobile telephone operator to create sufficient capacity in the network. In order to, in a rapid way, attain increased capacity for certain subscribers, there will by the invention be created possibilities to let the functionality vary for less prioritised subscriptions. This implies that the functionality for certain subscribers will be limited if the network is subject to high load, whereas other subscribers can have greater possibilities to utilise the full functionality.

Often a telephone user initiates temporary transfer to his/her mobile subscription when he/she moves from his office with a fixed subscription, and cancels the temporary transfer when he/she returns. This task requires an undertaking and initiative of the telephone user, and above all is implied that it is not forgotten. By the invention these changes/switching are automatized.

TECHNICAL SOLUTION

The invention describes a technical solution which makes it possible that the subscriber can be given different possibilities depending on where he/she is, or depending on point of time. By the invention changes of the functionality can be adjusted according to a schedule, or be changed by updating via the mobile telephone network.

According to the invention, SIM Application Toolkit is utilised so that the functionality differentiation is managed from the SIM-card. The only installation needed in the telecommunication network is possibly support for updating of the functionality differentiation.

The technical solution is based on a cellular mobile telephone network.

ADVANTAGES

By means of SIM Application Toolkit the whole functionality differentiation can be managed from the SIM-card. The only installation needed in the telecommunication network is possibly support for OTA-updating of the functionality differentiation.

The functionality differentiation can be made as far down as on cell level which is of great importance at for instance office telephony.

The subscriber´s functionality differentiation can in a simple way be changed because the list over allowed/wanted areas is in the SIM-card and can be updated via data message, for instance SMS.

It is very easy to differentiate the functionality differentiation; one can for instance subscribe to "low price rate" at for instance the office, the home and the summer cottage, and a higher price rate in other places.

By means of the invention one can arrange certain subscriptions so that the functionality can be varied. At high load the functionality for certain subscriptions can be limited to make it possible for other prioritised subscriptions to get sufficient access to network capacity. By that there is possibility to keep the access at a sufficiently high level in a mobile telephone network also during rapid expansion of the utilisation, or at disruptions in the traffic.

By changing the functionality depending on where the mobile telephone is, also switching can be made automatically in connection with that the mobile telephone is coming into an identified area. So can for instance temporary transfer to

fixed subscription be initiated when the mobile telephone is moved to the owner´s office. In the same way temporary transfer to the fixed subscription from the mobile telephone can be cancelled when the mobile telephone is moved from the owner´s office.

There also is possibility that the mobile telephone can initiate switching in another subscription, for instance initiate temporary transfer of call, by transmitting a data message such as an SMS-message. In that way temporary transfer of call from the fixed subscription can be initiated when the mobile telephone is moved from the owner´s office and vice versa.

LIST OF FIGURES

Figure 1 shows a cell in a cellular mobile telephone network, a mobile telephone and a SIM-card, as well as relations between these.

Figure 2 shows division of a cellular network in two areas where different conditions can apply for use of a mobile telephone subscription.

EXPLANATIONS OF TERMS

Cell	Geographical area related to a base station in mobile telephone network.
Cell ID	Identity of the base station in question
GSM	Global System for Mobile communication
LAC	Location Area Code

Location Area	The geographical area which is covered by one or, more often, more cells.
MCC	Mobile Country Code
ME	Mobile unit, mobile telephone unit without SIM-card.
MNC	Mobile Network Code
OTA	Over The Air; transparently for the user providing the SIM-card with new data (via the radio channel), often with short text message such as SMS.
SIM	Subscriber Identity Module
SIMAT	SIM Application Toolkit
SMS	Short Message Service; service for packet switched data.
USSD	Unstructured Supplementary Services Data; service for packet switched data.

DETAILED DESCRIPTION

References in the description below relates to Figure 1 and Figure 2 of the enclosed drawings.

PREFERRED EMBODIMENT

The technical solution utilises the possibility for applications in the mobile telephone to control functions and execute a dialogue with users and stations in the

mobile telephone network. By means of these functions the functionality, to which the user has access, is changed.

In the memory of the mobile telephone is stored information so that sufficient function scope can be identified for all geographical positions where the mobile telephone can be used. Suppose for instance that if full functionality applies to one area and in all other areas the functionality is limited to a certain group of functions. Then the area with full functionality shall be possible to be identified, for instance a limited number of cells (20) in a cellular network, and the amount of allowed functions in other cells (21) shall be identified.

Because this information may need to be changed, it shall be possible to update. Via a data message, for instance a SMS-message (3) which is transmitted to the mobile telephone, information about geographical area for certain functionality, or the scope of functionality for an appointed area etc, is changed.

In a cellular system there is information stored in the mobile telephone about in which cell the mobile telephone is. This information is loaded to the mobile telephone by the communication (3) between mobile telephone and the base station. According to the invention, the application, which controls the limitation of functionality, is provided with necessary information for control of the functionality.

In the application, which controls the limitation of functionality, there may be the following functions:

- The application sees to it when the functionality shall be changed. The changes can i.a. be caused by that the mobile telephone moves into a new cell (another area) or that a certain point of time has been reached. The

reason also can be that a message about that the functionality shall be changed has been received via the mobile telephone network.

- When the functionality shall be changed, for instance depending on that the mobile telephone is coming into a cell where other function scope or other price rate shall apply, the mobile telephone user's attention is drawn to the fact that functionality or price rate changes. This also can be executed by generating a sound signal and by showing a text message. Signal and text message are transmitted to the mobile telephone for instance via a data message such as a SMS-message.

- In order to limit outgoing calls, the application takes part in establishing new calls by all call set ups being subject to approval by the application before the set up.

- In order to limit incoming calls, the application can filter incoming calls. Calls which are not allowed are temporary transferred by the application to mobile answering service or other suitable number.

- If the mobile telephone is in a "call in progress"-state when a limit is passed (time or space limit) where the functionality is changed, the subscriber is informed by a sound signal being generated and a text message being shown. If calls are not allowed in the new area, the call is disconnected or routed to a voice answering machine or other number. Alternatively the call set up can be kept and extra price rate be applied, or another price rate be applied. This possibility can be predefined or controlled by subscriber.

The functionality differentiation can apply to i.a.:

- Incoming calls are not allowed, or are only allowed from certain numbers, area codes or the like.

- Outgoing calls are not allowed, or are only allowed to certain numbers, area codes or the like.

- Temporary transfer of incoming calls is not allowed.

- Forwarding of incoming calls is not allowed.

- Multi-party conference and alternation is not allowed.

- Calls in progress are allowed to be finished, even if the area limit is exceeded.

- Calls to emergency numbers are always allowed.

Full functionality but at changing price rate requires support in the network or in the billing system. This can be solved for instance by outgoing calls, which exceed a primary area where normal price rate applies, being re-routed or being given a prefix which is interpreted by the billing system. This can made by means of a function which allows that the application in the mobile telephone edits dialled number before set up is made. At already established connection, the network can be informed about that the mobile telephone is taken into another area with other price rate, by the application transmitting a data message, for instance via SMS or USSD to the network.

If the functionality differentiation is realised in SIM-card, there must be a function which verifies that required functionality exists in the mobile telephone. When the SIM-card is initiated in the mobile telephone, the functionality of the mobile telephone is checked, and if it does not correspond to the need of the functionality

differentiation, the mobile telephone only will be possible to use for emergency calls.

EXAMPLE OF EMBODIMENT IN GSM-NETWORK

The technical solution is based on the ETSI-standard GSM 11.14 - SIM Application Toolkit, which defines commands and procedures which make it possible for an application in the SIM-card to control certain functions of the mobile telephone and also execute a dialogue with the user.

Stored on the SIM-card (1) there shall be a list over the LACs (Local Area Code) and Cell IDs (Base station ID) where full functionality is given. This list can when necessary be updated OTA (Over The Air), i.e. by means of a data message, for instance a SMS-message (3), which transparently to the user provides the SIM-card with new data.

ME (2) can be made to provide the application in the SIM-card with information about current LAC and Cell ID by that ME by means of the command "PROVIDE LOCAL INFORMATION" is commanded to provide the SIM-card with current Location Information (MCC, MNC, LAC and Cell ID); this information is polled by one between the application and ME agreed interval. Alternatively the function "EVENT DOWNLOAD" is used where ME by means of "ENVELOPE (EVENT DOWNLOAD - Location Status)" can inform the application about that Location Information has been changed. The latter variant is to be preferred when information exchange between SIM and ME only need to be made at changed LAC or Cell ID.

The application in SIM compares the list over LACs and Cell IDs on SIM with the Location Information with which ME provides the application.

Depending on the design of the service, the application can for instance operate according to the following.

When the functionality shall be limited:

- The subscriber s attention should be drawn to the fact that he/she is coming into an area with other functionality or changed price rate, for instance by a sound signal being generated and a message being shown. This is solved by the SIM-card transmitting the commands "PLAY TONE" and "DISPLAY TEXT" to ME which makes this play wanted tone and show wanted text string.

- Limitation of outgoing calls is made by means of "Call Control by SIM", which means that all call set ups must be acknowledged by the application in the SIM-card before they can be performed.

- For limitation of incoming calls, the application can temporary transfer incoming calls to "Mobilsvar" (Mobile Answering) or other suitable number; this is made by means of the "SEND SS"-command in SIM Application Toolkit.

- If the mobile telephone is in "call in progress"-state at exit from allowed or wanted area, the call can be disconnected by being forwarded by means of the command "SET UP CALL", to a recorded announcement machine which gives information about the reason for the disconnection of the call. Instead of disconnecting the call it can be momentarily disconnected, for instance be set "on hold", and the subscriber can by a recorded announcement machine be given the option to, at extra price rate/charge, proceed with the call, or transfer the call to mobile answer function. Also at set up call the user

of course can be informed by text and sound signals before the call is disconnected.

If specific functionality shall be given, the embodiment will be the same as above, but possibly with possibility to perform certain functions such as:

- mobile originated calls to certain specific numbers are allowed
- temporary transfer of incoming calls is not allowed
- calls in progress are allowed to be finished, even if the area limit is exceeded

Full functionality but at other price rate requires support in the network or in the billing system. This can be solved for instance by that outgoing calls which are passing the borders out of a specified area, are re-routed or given a prefix which is interpreted by the billing system. This can be made by means of "CALL CONTROL BY SIM", which allows that the application in the SIM-card edits dialled number before set up is made. At already set up call, the network can be informed about exit from the area by the application transmitting a SMS-message or a USSD-string to the network (the commands "SEND SM", respective "SEND USSD").

The functional differentiation will work with GSM-telephones which support phase 2+. In order to prevent that the card is used in mobile telephones without support for SIM Application Toolkit, a function for control of this must be implemented in the application in the card. This function might be according to the following:

The SIM-card shall in the following two cases invalidate the data field EF_{IMSI}

- If the mobile telephone during the initiation of the SIM-card does not make a "PROFILE DOWNLOAD" which means that it does not support phase 2+.

- If the mobile telephone transmits a "PROFILE DOWNLOAD" but does not support the SIM Application Toolkit functions which are required.

In the above mentioned cases consequently EF_{IMSI} will be invalidated which means that the mobile telephone only can be used to make emergency calls. The function also has to restore EF_{IMSI} when the SIM-card is moved to an acknowledged mobile telephone.

In order to solve this, EF_{IMSI} shall be rehabilitated if EF_{IMSI} at the SIM-initiation is invalidated and "PROFILE DOWNLOAD" shows that the mobile telephone supports SIM Application Toolkit functions which are required.

The invention is not restricted to the above described embodiments, but may also be subject to modifications within the frame of the following patent claims and idea of invention.

PATENT CLAIMS

1. A method for differentiation of functionality in a cellular mobile telephone network, c h a r a c t e r i s e d in that the control of differentiation of functionality is made from the mobile telephone.

2. A method as claimed in patent claim 1, c h a r a c t e r i s e d in that the functionality can be differentiated for instance in time, in space, in debiting, in degree of change.

3. A method as claimed in patent claim 1 or 2, c h a r a c t e r i s e d in that the functionality differentiation can be changed without interference by the mobile telephone user, for instance via a data message such as an SMS-message.

4. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that the mobile telephone network is a GSM-network and that the technical solution is realised by the ETSI-standard GSM 11.14 - "SIM Application Toolkit".

5. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that information for that available functional scope shall be possible to identify at all points of time and at all geographical positions where the mobile telephone can be used is stored on memory in the mobile telephone.

6. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that the in the mobile telephone stored application sees to it when the functionality shall be changed, for instance depending

on that the mobile telephone is coming into a new cell, or that a certain point of time has been reached, or that a message about that the functionality shall be changed has been received via the mobile telephone network.

7. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that the mobile telephone user´s attention is drawn to that functionality or price rate is changed by a sound signal being generated and a text message being shown.

8. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that call set ups are not established without acknowledgement by the in the mobile telephone stored application.

9. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in the following possibilities:

- incoming and outgoing calls are not allowed, or are allowed only from, respective to, certain numbers, area codes or the like.
- temporary transfer and forwarding of incoming calls are not allowed.
- multi-party conference and alternation are not allowed.
- calls in progress are allowed to be finished, even if the area border is exceeded.
- calls to emergency numbers are always allowed.

10. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that there is support in the network or in the billing system to make it possible to apply varying debiting.

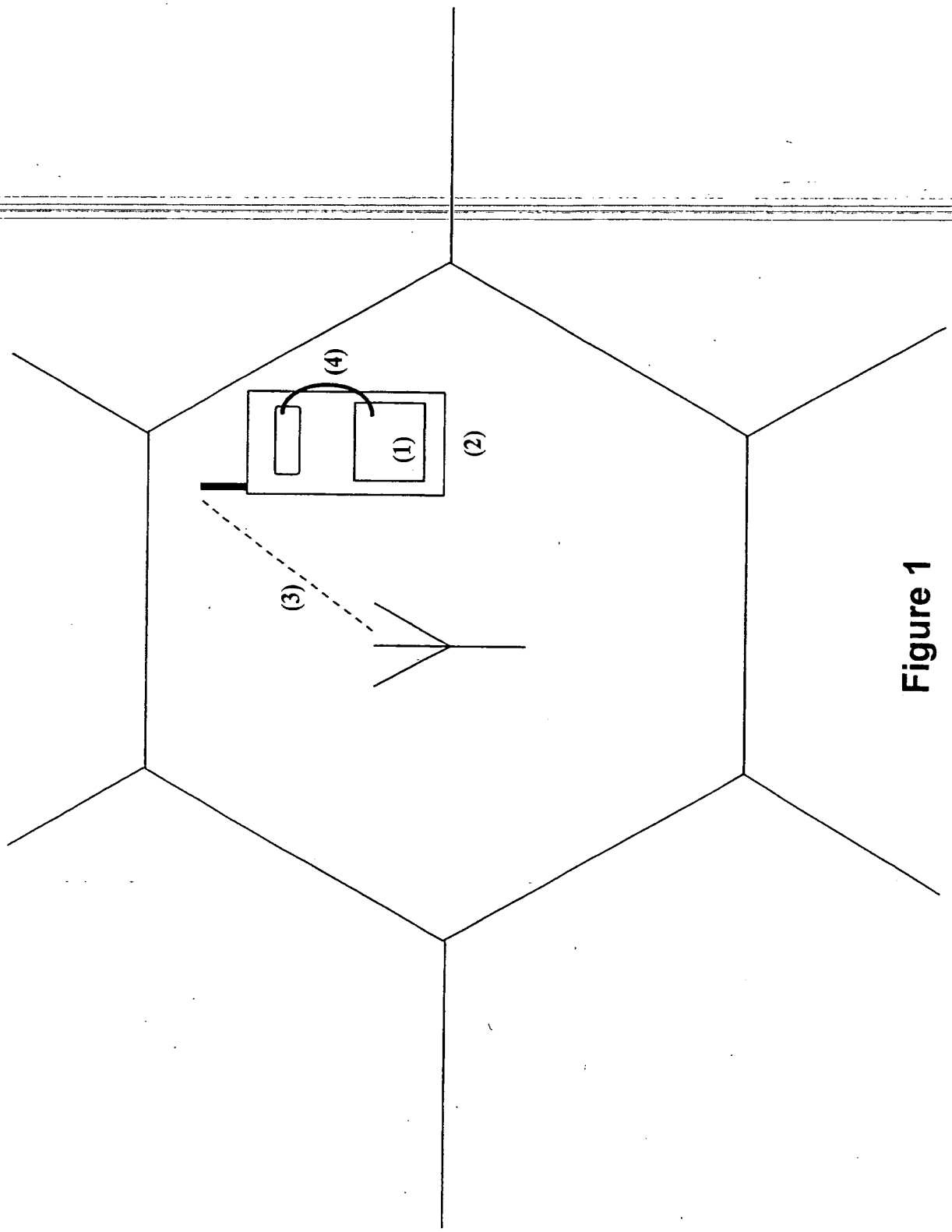

Figure 1

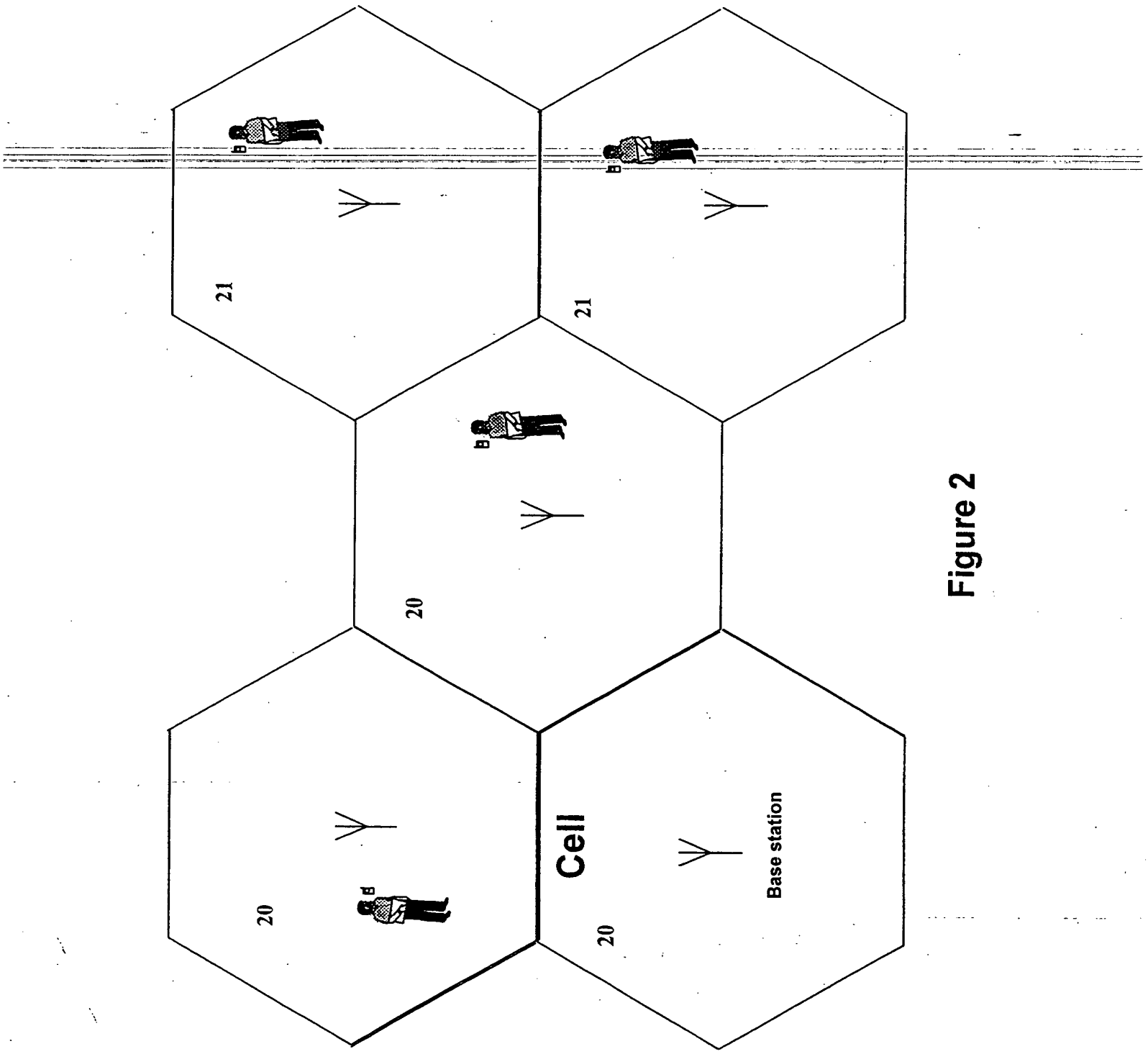

Figure 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/01638

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22, H04Q 7/32
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	WO 9728662 A1 (NOKIA MOBILE PHONES LIMITED), 7 August 1997 (07.08.97), page 4, line 19 - line 29	1,3-4,9-10
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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